

REMARKS

In section 3 of the Office Action, the Examiner rejected claims 27, 28, and 30 under 35 U.S.C. §102(e) as being anticipated by Chen.

Chen states that both a feed-forward equalizer and a decision feedback equalizer include a filter that may be implemented as a transversal filter structure shown in Figure 1A. Chen also states that the first portion of a decision feedback equalizer may be implemented as a transposed filter shown in Figure 1B, and that takes as an input the intermediate decoded symbols from the trellis decoder.

The output of the $(K+1)$ -tap of the transversal filter is given by the following equation:

$$y_1(n) = \sum_{k=0}^K c_k(n)x(n-k)$$

where $x(n)$ is the input symbol at symbol clock n , and where $c_k(n)$ is the tap value of the k^{th} tap in the n^{th} symbol clock period.

The output of the $(K+1)$ -tap of the transposed filter is given by the following equation:

$$y_2(n) = \sum_{k=0}^K c_k(n-k)x(n-k)$$

According to Chen, when the tap values of the filters are fixed, $y_2(n)$ is equal to $y_1(n)$ and the transposed filter is identically equivalent to the transverse filter. However, when the tap values vary over time, $y_2(n)$ is not necessarily equal to $y_1(n)$. Therefore, the transposed filter is not precisely equivalent to the transverse filter. However, because the tap values of the equalizer change gradually and slowly on a symbol-by-symbol basis, the increase and decrease of the taps is very small within a K-symbol neighborhood if the total tap number K is small. Thus, a given value for the K^{th} tap is approximately equal to it's value K symbol clock cycles before or, in equation form,

$$c_k(n) \approx c_k(n-k)$$

for $k = 1, 2, \dots, K$.

Thus, for a small number of taps, the transposed and transverse structures are functionally equivalent during adaptation of the equalizer, and the

transposed structure can be employed without practical degradation of the equalizer's performance.

Figure 2 shows the feedback filter and decoder of a decision feedback equalizer. The feedback filter is divided into parts 1 and 2. The decoder is a trellis decoder having N stages shown as columns and D decoding banks shown as rows. A trellis decoder having D decoding banks and N stages holds $N \times D$ inner intermediate decoded symbols.

When the feedback filter is combined with a trellis decoder, all $N \times D$ inner intermediate decoded symbols are re-arranged in an equivalent $N \times D$ symbol delay line in the order in which they are received by the trellis decoder. This temporal order is fed into the feedback filter to produce the desired ghost estimate.

The first part of the feedback filter combined with the trellis decoder can be implemented as N transposed filter pipelines, each covering D taps and taking as its input a corresponding one of the N inner intermediate decoded symbols. The outputs from all transposed pipelines are summed together to produce a ghost estimation feedback filter output.

The N transposed filter pipelines of the feedback filter may be implemented as a series of

cascaded pipes. Figure 3 shows only the two rightmost pipes. Each pipe covers a group of L consecutive taps. Thus, there are L data registers R in each pipe. Each group of L consecutive taps feeds into one of the pipes, the first tap group starting with $c_0(n)$ through $c_{L-1}(n)$.

Figure 4 shows an alternative fast-feedback reuse pipe structure that can be used for the pipelines of Figure 2.

Independent claim 27 is directed to a method of operating an equalizer. Segments of received symbols are supplied to the equalizer to produce equalized segments. Each of the segments of received symbols occupies a corresponding segment time period. The equalized segments are decoded by a decoder to produce decoded segments. Adjustments for the equalizer are calculated based on n decoded segments and n segments of received symbols, where $n \geq 1$. This calculation is performed in a pipelined manner at least twice per segment time period. The adjustments are applied to the equalizer.

Chen does not show calculating adjustments for an equalizer in a pipelined manner at least twice per segment time period. According to the Examiner, the adjustments of the equalizer shown in Chen are made to the tap values $c_{L-1}(n)$ through $c_0(n)$. However, Chen does

not disclose how to calculate these adjustments to the tap values and, therefore, cannot disclose calculating them in a pipelined manner.

The decoder shown in Figure 2 does not calculate the tap values. It merely feeds symbol decisions to the feedback filter of the decision feedback equalizer in a non-typical manner. In the typical manner, symbol decisions are feed serially into the first delay register of the feedback filter. However, as shown in Chen, inner intermediate symbol decisions are feed in parallel to the multiple delay registers of the feedback filter. Either way, the decoder does not calculate the tap values.

Moreover, while Chen shows a pipelined equalizer, it is the stages of the equalizer that are pipelined, not the calculation of the tap values.

The Examiner is apparently of the belief that the tap values of the feedback filter must be calculated in a pipelined manner if the equalizer itself has a pipelined structure. However, as the Examiner will appreciate, tap values of an equalizer need not be calculated in a pipelined manner even though the equalizer itself has a pipelined structure. The tap values for a pipelined equalizer could be calculated in a

pipelined manner using applicants' invention. However, prior to applicants' invention, tap values for a pipelined equalizer were not calculated in a pipelined manner.

Accordingly, for all of the above reasons, independent claim 27 is not anticipated by Chen.

Because independent claim 27 is not anticipated by Chen, dependent claims 28 and 30 are likewise not anticipated by Chen.

CONCLUSION

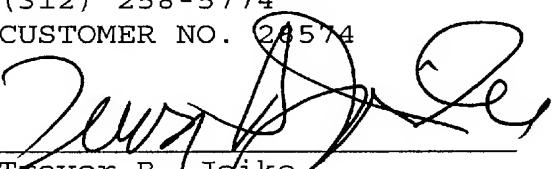
In view of the above, it is clear that the claims of the present application are patentable over the art applied by the Examiner. Accordingly, allowance of these claims and issuance of the above captioned patent application are respectfully requested.

The Commissioner is hereby authorized to charge any additional fees that may be required, or to credit any overpayment, to account No. 260175.

Respectfully submitted,

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January 2, 2008